United States Patent [19]

Manecke et al.

[11] **3,995,245**

[45] **Nov. 30, 1976**

[54] **THERMOSTAT CONSTRUCTION AND METHOD OF MAKING THE SAME**

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[52] **U.S. Cl.** **337/380;** 337/368

[51] **Int. Cl.²** **H01H 37/04;** H01H 37/52

[58] **Field of Search** 337/343, 346, 347, 365, 337/367, 368, 380, 381

[56] **References Cited**

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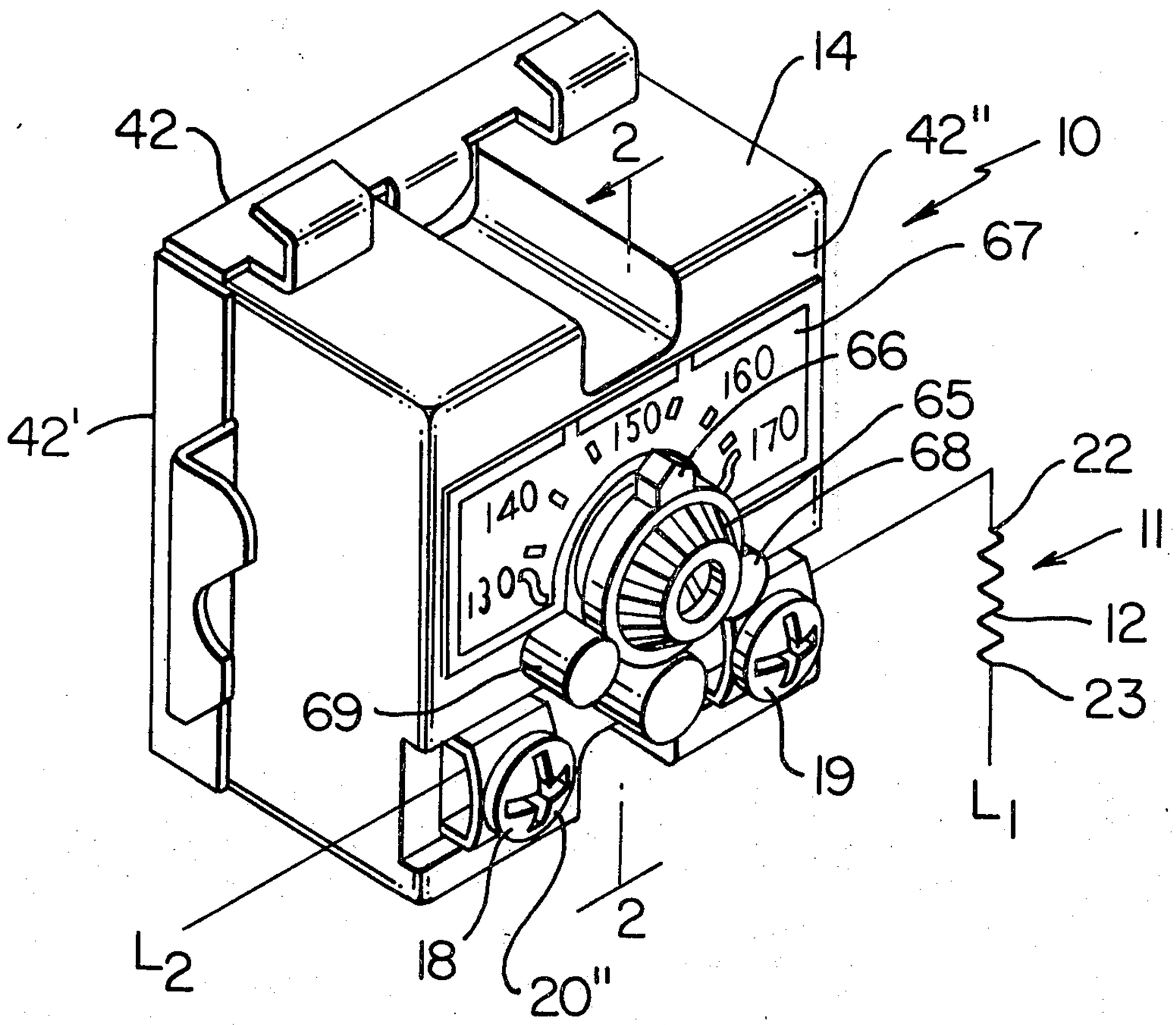
[57] **ABSTRACT**

A thermostat construction having a first contact and a blade-carried second contact supported in a generally cube-like housing and having a bimetal snap disc carried by the housing for controlling movement of the second contact relative to the first contact in response to snapped temperature sensing conditions of the disc together with temperature setting means carried by the housing for selecting the temperature of operation of the disc for moving the second contact out of contact with the first contact whereby the generally cube-like configuration of the housing renders the thermostat construction relatively small and compact.

10 Claims, 7 Drawing Figures



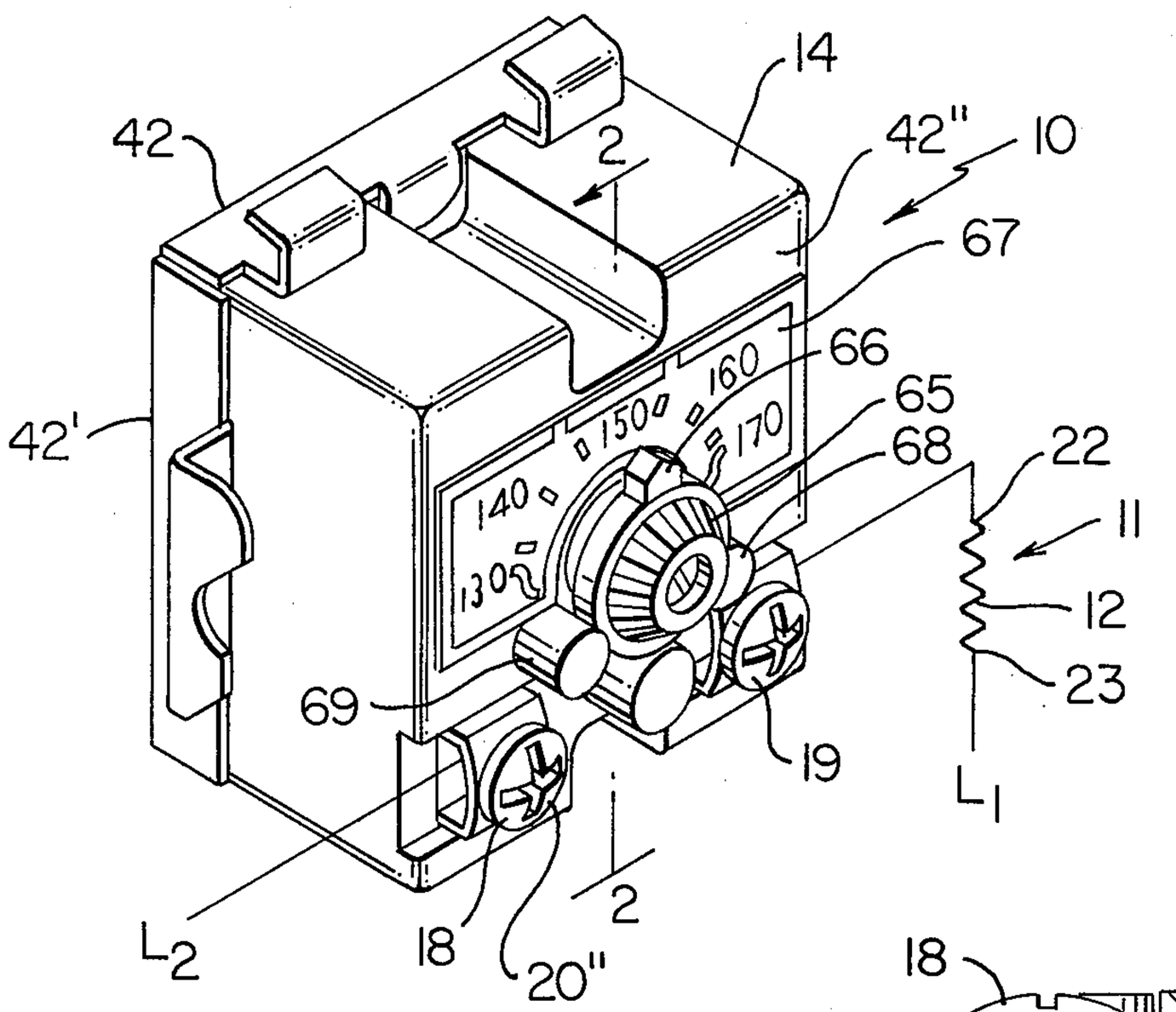


FIG. 1

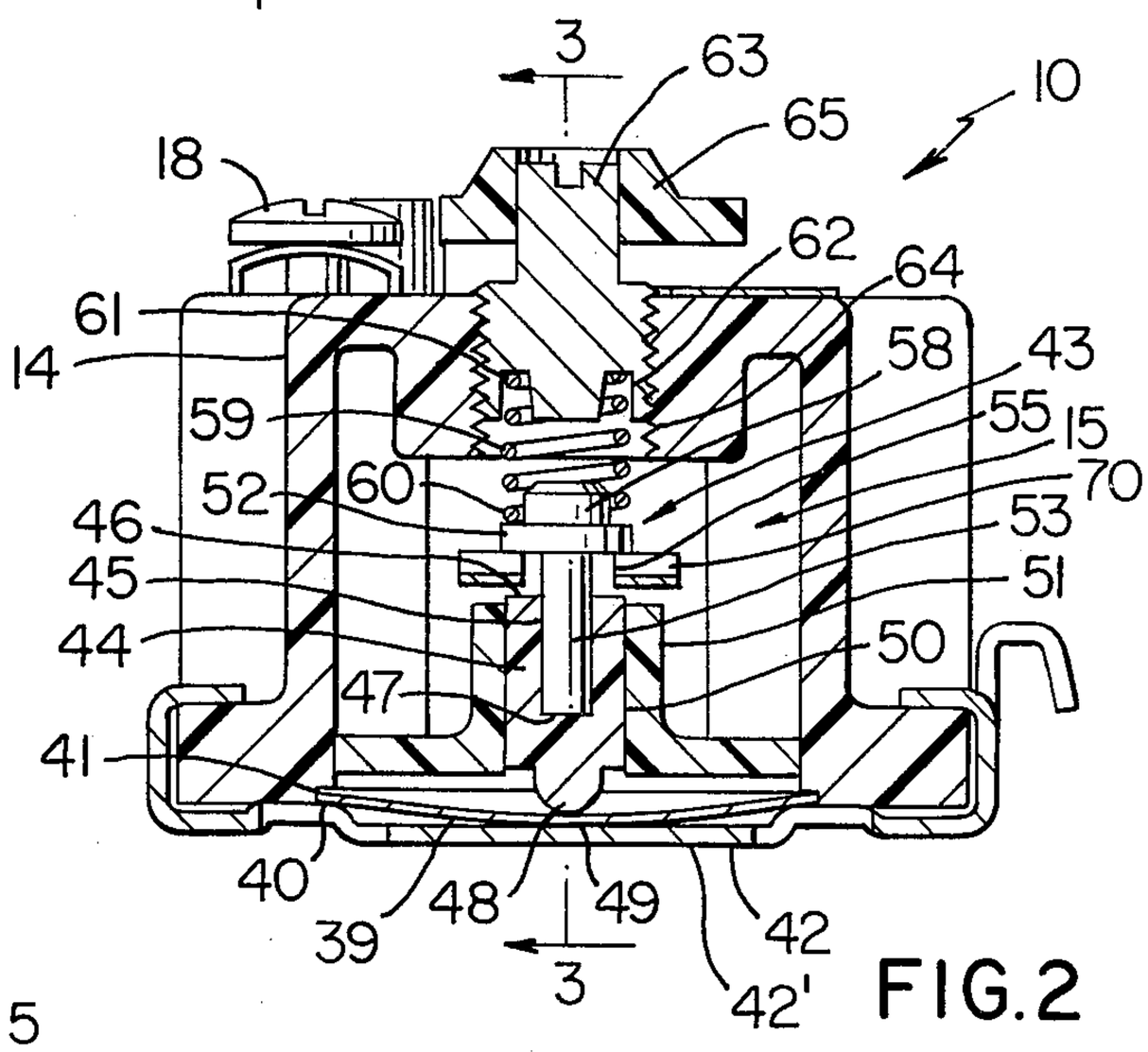


FIG. 2

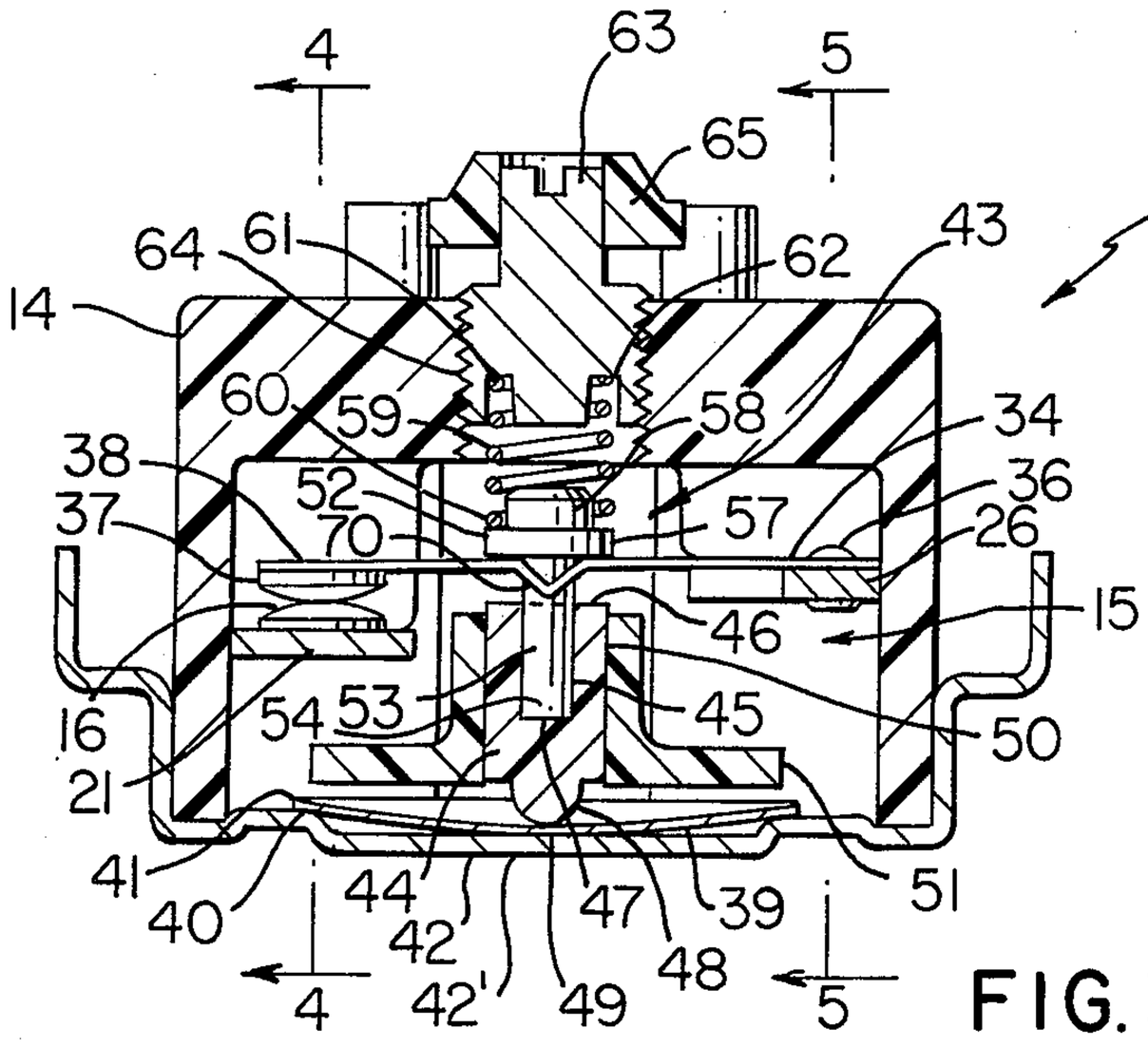


FIG. 3

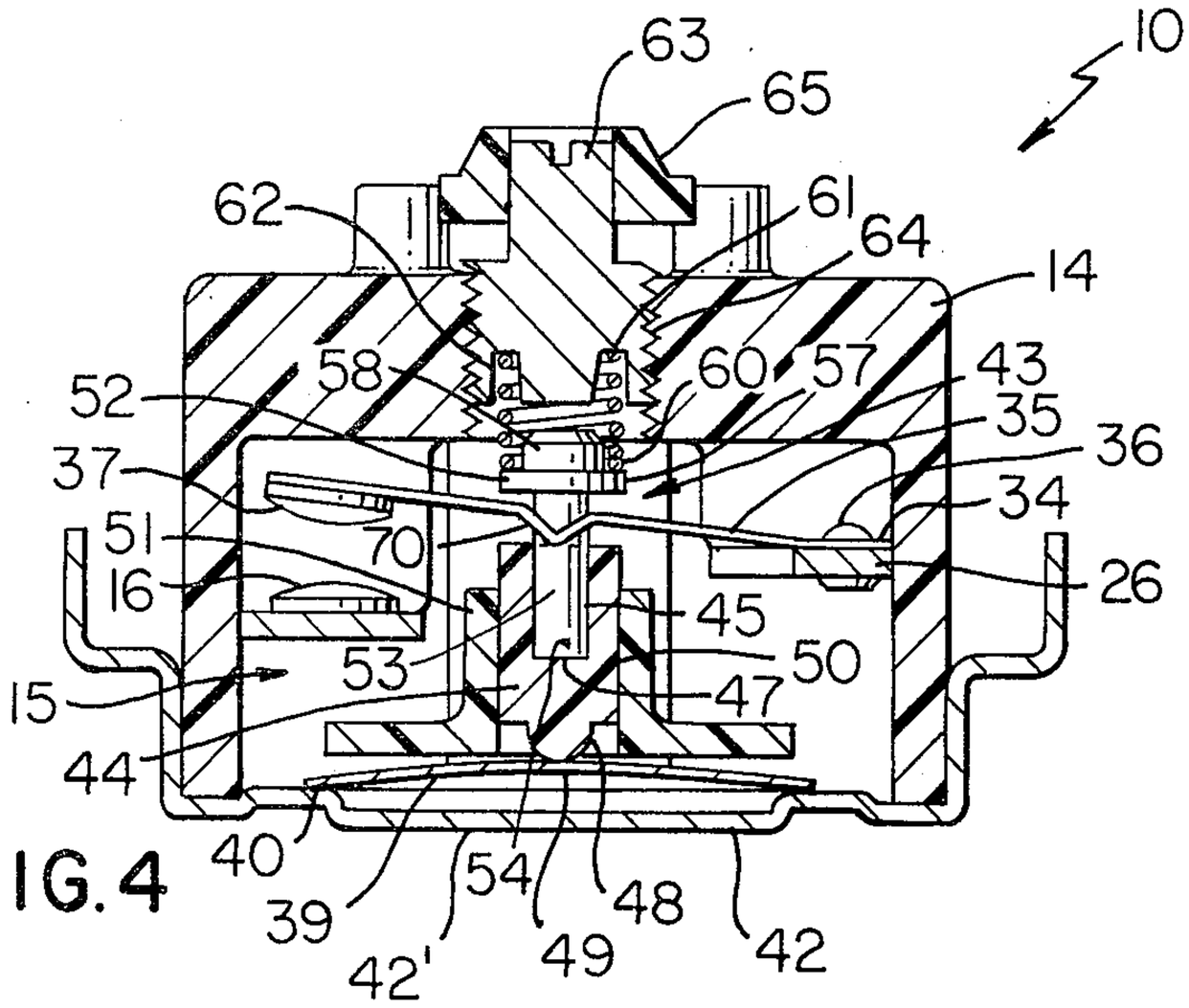


FIG. 4

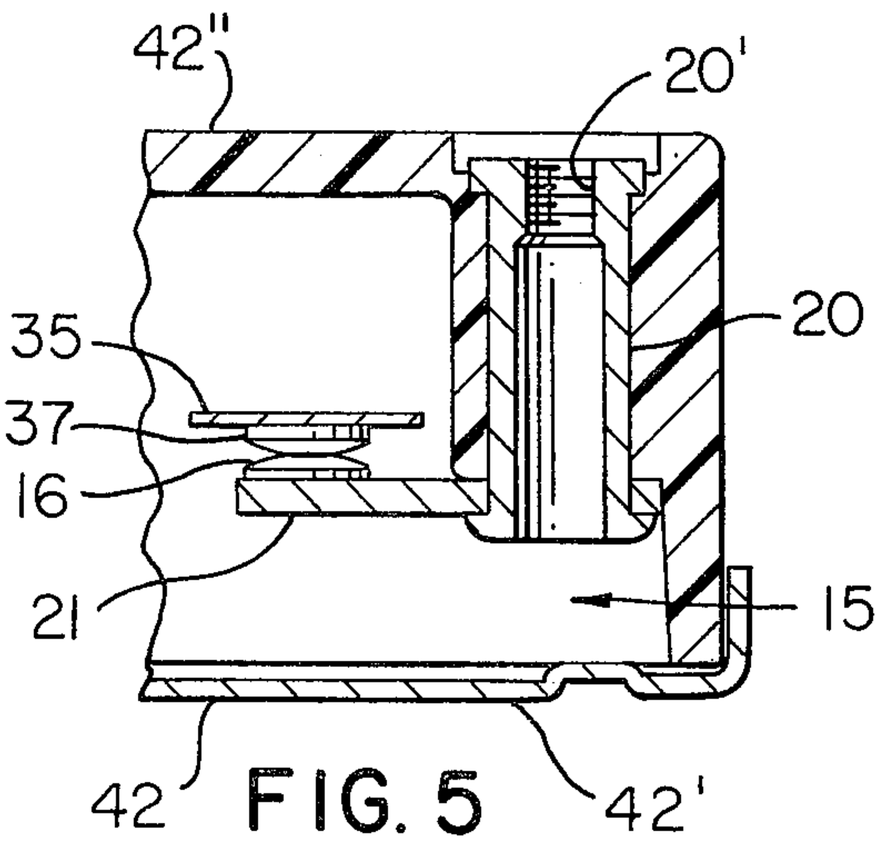


FIG. 5

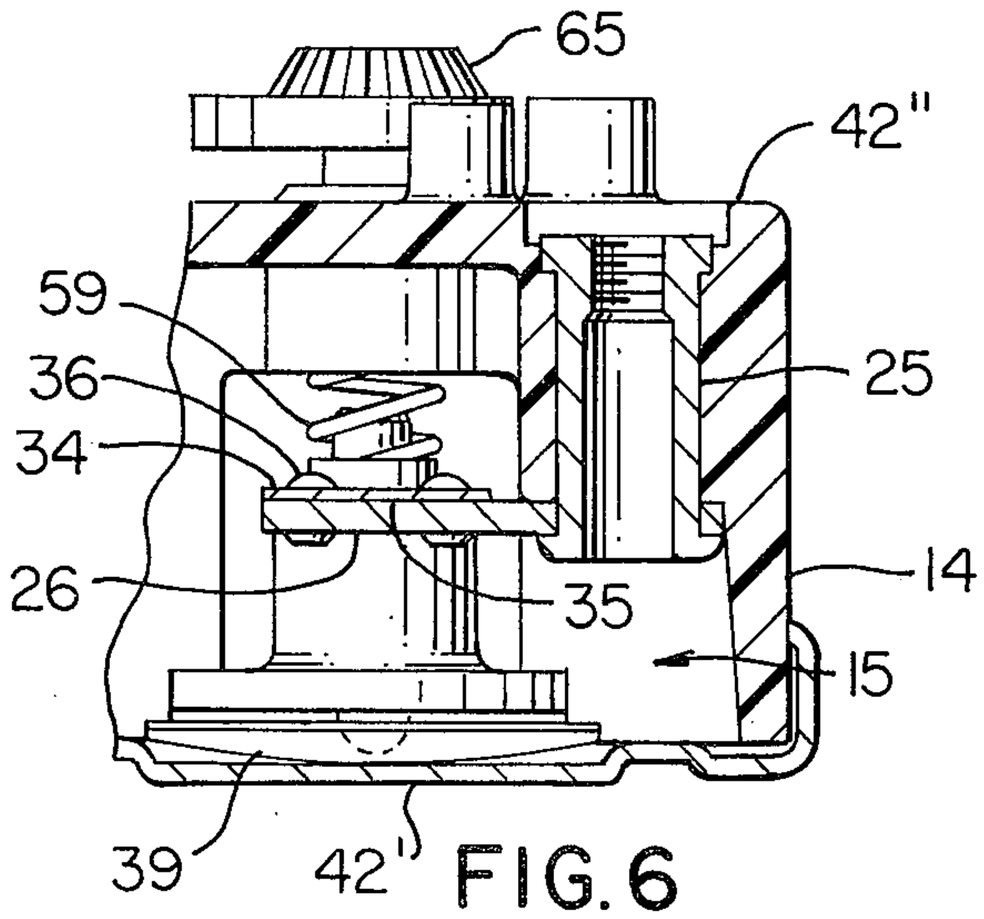


FIG. 6

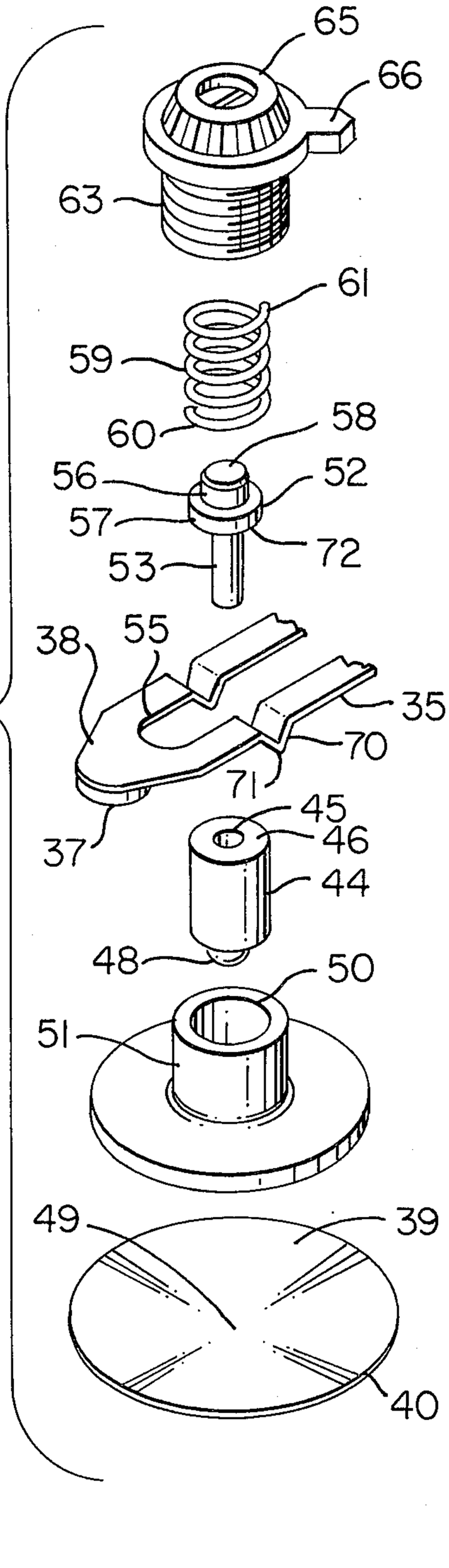


FIG. 7

THERMOSTAT CONSTRUCTION AND METHOD OF MAKING THE SAME

This invention relates to an improved thermostat construction and to a method of making the same or the like.

It is well known that thermostat constructions have been provided wherein each has a first contact and a blade-carried second contact supported in a housing means and having a bimetal snap-disc carried by the housing means for controlling movement of the second contact relative to the first contact in response to snapped temperature sensing conditions of the disc together with temperature setting means carried by the housing means for selecting the temperature of operation of the disc for moving the second contact out of contact with the first contact.

For example, see the Manecke, U.S. Pat. No. 3,870,229, and its related co-pending patent application Ser. No. 408,678, filed Oct. 23, 1973, now U.S. Pat. No. 3,885,222 both of which are assigned to the same assignee to whom this application is assigned.

It is a feature of this invention to provide a thermostat construction of the aforementioned type wherein the same has a generally cube-shaped housing means so that all of the thermostat parts are arranged in a compact relationship inside the cube-shaped housing means to provide a thermostat construction that is relatively small in comparison with the prior known thermostat constructions.

Accordingly, one embodiment of this invention provides a thermostat construction having a first contact and a blade-carried second contact supported in a generally cube-like housing means and having a bimetal snap disc carried by the housing means for controlling movement of the second contact relative to the first contact in response to snapped temperature sensing conditions of the disc together with temperature setting means carried by the housing means for selecting the temperature of operation of the disc for moving the second contact out of contact with the first contact whereby the cube-like housing means renders the thermostat construction relatively small and compact.

Accordingly, it is an object of this invention to provide an improved thermostat construction having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved method of making such a thermostat construction of the like.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. **1** is a front perspective view of the improved thermostat construction of this invention.

FIG. **2** is a cross-sectional view taken on line **2—2** of FIG. **1.**

FIG. **3** is a cross-sectional view taken on line **3—3** of FIG. **2** and illustrates the thermostat construction with the contacts thereof in the closed position thereof.

FIG. **4** is a view similar to FIG. **3** and illustrates the contacts of the thermostat construction in the open condition thereof.

FIG. **5** is a fragmentary, cross-sectional view taken on line **5—5** of FIG. **3.**

FIG. **6** is a fragmentary cross-sectional view taken on line **6—6** of FIG. **3.**

FIG. **7** is an exploded perspective view of the various temperature setting parts of the thermostat construction of FIG. **1.**

While the various features of this invention are hereinafter described and illustrated as being particularly adapted to provide a thermostat construction for a water heater or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide a thermostat construction for other uses as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. **1–6,** the improved thermostat construction of this invention is generally indicated by the reference numeral **10** and is illustrated schematically in FIG. **1** as being utilized in an electrical control system that is generally indicated by the reference numeral **11,** the electrical control system **11** comprising a pair of power source leads L1 and L2 adapted to energize an electrical heater means **12** when the thermostat construction **10** is disposed in the condition illustrated in FIG. **3** in a manner hereinafter set forth and for disconnecting the power source lead L2 from the electrical heater means **12** when the thermostat construction **10** is disposed in the condition illustrated in FIG. **4** in a manner hereinafter described.

The thermostat construction **10** comprises a generally cube-shaped housing means **14** having a chamber **15** therein containing a fixed contact **16** interconnected to a terminal means **18** adapted to be interconnected to the power source lead L2 while another terminal means **19** is adapted to be interconnected to one side **22** of the electrical heater means **12,** the other side **23** of the heater means **12** being interconnected to the power source lead L1.

The terminal means **18** for the fixed contact **16** includes a conductive insert **20,** FIG. **5,** carried by the housing means **14** and interconnected to a relatively rigid blade **21** disposed in the chamber **15** and carrying the fixed contact **16,** the insert **20** having a threaded opening **20′** therein to receive a threaded fastening member **20″** of the terminal means **18** to electrically attach the power source lead L2 thereto.

The other terminal means **19** of the housing means **14** includes a like conductive insert **25,** FIG. **6,** interconnected to a relatively rigid blade **26** disposed inside the chamber **15** of the housing means and being electrically interconnected to the right-hand end **34** of a conductive switch blade **35** that is fastened thereto by suitable rivet means **36.** The switch blade **35** carries contact means **37** on the left-hand free end **38** thereof with the contact means **37** being cooperable wtih the fixed contact **16** in the manner illustrated in FIGS. **3** and **4.** However, the natural bias of the spring blade **35** is to move the blade **35** downwardly in the manner illustrated in FIG. **3** to normally place the contact means **37** into good electrical contact with the fixed contact **16** as illustrated.

A bimetallic snap disc of substantially circular configuration **39** is carried by the housing means **14** and has its outer periphery **40** received within a recess **41** formed in the housing means **14** and being held in the recess **41** by a cover member **42** detachably carried by the housing means **14** and closing the chamber **15**

thereof as illustrated, the cover member **42** thereby defining a generally square shaped rear face **42'** of the housing means **14.**

A plunger means **43** of the thermostat **10** comprises a first plunger part **44** having an opening **45** interrupting one flat end **46** thereof to terminate within the part **44** at an end wall **47.** The other end **48** of the plunger part **44** is formed with a hemispherical configuration and is adapted to engage against the central part **49** of the snap disc **39** as illustrated.

The plunger part **44** is disposed within a guide opening **50** passing through a guide part **51** secured in the chamber **15** of the housing means **14** in any suitable manner to locate and guide the axial up and down movement of the plunger means **43** between the positions illustrated in FIGS. **3** and **4.**

The plunger means **43** has another plunger part **52** that is substantially rivet-shaped so as to have a stem **53** thereof received wtihin the opening **45** of the first plunger part **44** and have its free end **54** bottom out against the end wall **47** at the end of the opening **45** of the plunger part **44** as illustrated in FIGS. **3** and **4.** The stem **53** of the plunger part **52** passes loosely through an opening **55** formed centrally through the switch blade **35** as illustrated in the drawings so that the stem **53** does not engage the blade **35** but permits axial movement therebetween.

However, the rivet-like part **52** of the plunger means **43** has a hat-shaped head **56** defined by a first disc-like part **57** adjacent the stem **52** and a smaller disc-like part **58** on top of the disc-like part **57** to act as a spring locating means. For example, a compression spring **59** is carried by the housing means **14** and has one end **60** telescopically disposed over the disc part **58** to rest against the lower disc part **57** as illustrated in FIG. **4** and has another end **61** received within an annular recess **62** of a threaded adjusting member **63** threadedly disposed in a threaded bore **64** formed generally medially of the generally square shaped front face **42''** in the housing means **14** and leading from the exterior thereof to the chamber **15** as illustrated.

The adjusting member **63** has a knob construction **65** secured thereto or formed integrally therewith, as desired, whereby rotation of the knob **65** varies the threaded relation of the threaded member **63** within the housing means **14** and, thus, the force of the compression spring **59** urging the plunger means **43** into engagement with the central part **49** of the snap disc **39.** If desired, the knob **65** can have a suitable pointer means **66** extending therefrom to be movable adjacent a scale **67** on the front face **42''** of the housing means **14** as illustrated in FIG. **1** to indicate the temperature setting position of the knob **65** and, thus, the temperature setting of the temperature setting means for the thermostat construction **10.** If desired, outwardly extending stops or abutments **68** and **69** can be provided on the housing means **14** to limit rotational movement of the knob **65** to the right and left as illustrated in FIG. **1** as the pointer part **66** of the knob **65** will abut against the stops **68** and **69** when at the opposed limits of its temperature setting positions.

Thus, by varying the threaded relation of the threaded member **63** with the housing **14,** the force of the compression spring **59** urging the plunger means **43** into engagement with the central part **49** of the snap disc **39** varies the temperature required for the snap disc **39** to snap from the condition illustrated in FIG. **3** to the condition illustrated in FIG. **4** upon the principles fully set forth in the Spencer, U.S. Pat. No. 2,239,540, whereby the theory and operation of the change in the spring force being imposed on the snap disc **39** to change the temperature required to snap the disc **39** over center in either direction need not be further described.

The switch blade **35** is provided with V-shaped, bent projections **70** on both sides of the opening **55** passing therethrough so that the apex portions **71** of the V-shaped projections **70** are adapted to be engaged by the annular shoulder or wall **46** of the plunger part **44** as the plunger part **44** is being moved upwardly from the position illustrated in FIG. **3** to the position illustrated in FIG. **4** whereby the take-up of the lost motion provided between the annular shoulder **46** and the projections **70** of the blade **35** before the plunger part **44** engages the blade **35** causes the plunger part **44** to abruptly engage the switch blade **35** and move the same upwardly from the position illustrated in FIG. **3** to the position illustrated in FIG. **4** as the snap disc **39** is snapping over center so that any contact weld that might exist between the movable contact **37** and the fixed contact **16** will be broken by such lost motion take-up movement of the plunger part **44.**

The snap distance of the snap disc **39** is so constructed and arranged that when the disc **39** is fully snapped over center in the manner illustrated in FIG. **4,** the plunger part **44** will hold the movable contact **37** out of contact with the fixed contact **16** in opposition to the force of the normal bias of the spring blade **35** tending to return the movable contact **37** to its down position as illustrated in FIG. **3.** However, when the snap disc **37** subsequently snaps back over center from the position illustrated in FIG. **4** to the position illustrated in FIG. **3,** the plunger means **43** will follow such movement of the disc **39** because of the downward force of the compression spring **59.** Thus, the plunger part **52** will cause the blade **35** to move downwardly until the movable contact **37** is again placed in contact with the fixed contact **16.** Such movement of the blade **35** takes place with substantially a snap motion because the compression spring **59** causes the plunger part **52** to follow the snap movement of the disc **39.**

Thus, it can be seen that in the operation of the electrical control system **11,** when the temperature sensing condition of the snap disc **39** causes the snap disc **39** to be in the position illustrated in FIG. **3,** the heating element **12** is being placed across the power source leads **L1** and **L2** and is, thus, being operated by the thermostat **10.** However, when the temperature being sensed by the snap disc **39** changes in such a manner that the same reaches the temperature for which the control knob **65** has been set, the snap disc **39** snaps over center and through the plunger means **44** in the manner previously described snaps the switch blade **35** from the position illustrated in FIG. **3** to the position illustrated in FIG. **4** whereby the heater means **12** is effectively disconnected from the power source lead **L2.** Conversely, when the temperature being sensed by the snap disc **39** returns to the condition that will cause the snap disc **39** to snap back to the position illustrated in FIG. **3,** the snap disc **39** snaps back over center from the position illustrated in FIG. **4** to the position illustrated in FIG. **3** to again interconnect the power source lead **L2** back to the heater means **12.**

Therefore, it can be seen that the thermostat construction **10** is readily adapted to control a switching operation by the plunger means **43** that serves the dual

purpose of setting the operating temperature for the thermostat disc **39** as well as providing opposed abutment means **46** and **72** to move the switch blade **35** between its two positions in a lost motion take-up manner to overcome any welding between the movable contact **37** and the fixed contact **16** in the manner as previously set forth.

Further, by having the plunger means **43** pass through the opening **55** in the blade **35,** the blade **35** is not utilized in any manner to translate the motion or force of the compression spring **59** to the central part **49** of the snap disc **39** as provided in the aforementioned patents to Spencer, U.S. Pat. No. 2,239,540, and Manecke, U.S. Pat. No. 3,870,229, and all of the parts **44, 52, 63** and **65** for the temperature setting means of the thermostat **10** are in direct alignment with each other and with the snap disc **39** to provide for accurate temperature setting control for the snap disc **39.**

Also, it can be seen that all of the parts **44, 52, 63** and **65** for the temperature setting means of the thermostat **10** pass substantially centrally through the cube-shaped housing means **14** as the snap disc **39** is disposed generally medially of the rear face **42'** inside the chamber **15** while the knob **65** of the temperature setting means of the thermostat **10** is disposed generally medially of the front face **42''**. Further, the terminal means **18** and **19** are disposed in aligned relation adjacent the lower edge of the generally square shaped front face **42''** of the cube-shaped housing means **14.**

In this manner, a relatively compact thermostat construction **10** is provided which is adapted to control the temperature of the heating means **12** in the manner previously described depending upon the setting of the control knob **65** for the reasons previously set forth.

Therefore, it can be seen that this invention not only provides an improved thermostat construction having improved housing means therefor, but also this invention provides a method of making such a thermostat construction or the like.

While the form and method of this invention now preferred have been disclosed as required by the Patent Statute, it is to be understood that other forms and method steps may be utilized and still come within the scope of the appended claims.

What is claimed is:

1. In a thermostat contruction having a first contact and a blade-carried second contact supported in a housing means and having a bimetallic snap disc carried by said housing means for controlling movement of said second contact relative to said first contact in response to snapped temperature sensing conditions of said disc together with temperature setting means carried by said housing means for selecting the temperature of operation of said disc for moving said second contact out of contact with said first contact, the improvement wherein said housing means is generally cube-like in configuration and thereby small and compact.

2. In a thermostat construction as set forth in claim **1,** said cube-like housing means having a generally square front face, said temperature setting means being generally medially disposed adjacent said front face of said housing means.

3. In a thermostat construction as set forth in claim **2,** said housing means having two terminal means on said front face thereof and being respectively electrically interconnected to said first and second contacts in said housing means.

4. In a thermostat construction as set forth in claim **3,** said front face of said housing means having four side edges, said two terminal means being disposed in aligned relation adjacent one of said side edges.

5. In a thermostat construction as set forth in claim **4,** said housing means having a generally square rear face, said disc being generally medially disposed adjacent said rear face inside said housing means.

6. In a method of making a thermostat construction having a first contact and a blade-carried second contact supported in a housing means and having a bimetallic snap disc carried by said housing means for controlling movement of said second contact relative to said first contact in response to snapped temperature sensing conditions of said disc together with temperature setting means carried by said housing means for selecting the temperature of operation of said disc for moving said second contact out of contact with said first contact, the improvement comprising the step of forming said housing means to be generally cube-like in configuration and thereby small and compact.

7. In a method of making thermostat contruction as set forth in claim **6** wherein said step of forming said housing means causes said cube-like housing to have a generally square front face, and disposing said temperature setting means generally medially adjacent said front face of said housing means.

8. In a method of making a thermostat construction as set forth in claim **7,** the additional step of forming two terminal means on said front face of said housing means to be respectively electrically interconnected to said first and second contacts in said housing means.

9. In a method of making a thermostat construction as set forth in claim **8** wherein said step of forming said housing means causes said front face of said housing means to have four side edges, said step of disposing said two terminal means comprising the step of disposing said two terminal means so as to be in aligned relation adjacent one of said side edges.

10. In a thermostat construction as set forth in claim **9** wherein said step of forming said housing means causes said housing means to have a generally square rear face, and disposing said disc so as to be generally medially disposed adjacent said rear face inside said housing means.

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